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Soil
Conservation
Service

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TECHNICAL NOTE

RANGE TECHNICAL NOTE NO. 2

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A RANGELAND MONITORING TECHNIQUE

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INTRODUCTION

The purpose of rangeland monitoring is to determine if ongoing management actions are having the desired effect on the resource. To evaluate management actions, measurable management objectives must be established. The monitoring program must be able to determine whether objectives are or are not being reached and identify what areas of management need revision.

As a grazing management plan is developed, a monitoring plan should also be developed, becoming an integral part of the management plan. The objectives of the monitoring, sampling techniques, transect locations, monitoring responsibilities, and timetable should be detailed as near as possible during conservation plan development. Monitoring is as an important part of the conservation plan as is the grazing system, stocking rates, or water developments.

Responsibility for collecting monitoring data should fall on the producer. The producer has a more intimate knowledge of the resource conditions which will affect the monitoring process and results. In addition, if the producer takes responsibility, management changes which are dictated by the results of the monitoring are more likely to be implemented in a timely manner. At the very minimum, the producer should be present when all monitoring data is collected.

This monitoring technique will consist of collecting climatic, livestock grazing, and vegetative records. Precipitation records are an important part of this program. Livestock grazing records consisting of the number of animals, length of stay, and utilization of vegetation will be collected for each pasture. Vegetative records will consist of annual photographs and transect data on vegetation frequency, cover, and range condition.

Producers should be strongly encouraged to collect as much data on their operation as possible. Detailed livestock production and cost data will further enhance the opportunity to make sound grazing management decisions based on both biological and economic considerations. It is highly recommended that the producer develop a monitoring notebook where all monitoring data can be kept in one location.

CLIMATIC DATA

Climatic data is essential for the interpretation of other monitoring data. Daily precipitation data is a required part of the monitoring

program. Without this data it is very difficult to draw any conclusions about the animal and plant resources over time.

Because of extreme local variation, precipitation records should be collected from an area which is as close to the monitoring location as possible. On large units, several rain gauges may be required to adequately reflect variations in precipitation across a given landscape. On other units one centrally located rain gauge at the headquarters may be sufficient. Precipitation should be recorded on a daily basis.

The attached form will provide a location for the producer to record their precipitation data. Other climatic data that may be important to record includes remarks on: floods, hail, snow depth and persistence, snow drifting, temperatures, wind patterns, storm patterns, unusual freezes, etc.

LIVESTOCK GRAZING DATA

Livestock grazing records will be collected on each pasture grazed as a part of the grazing management system. This data provides a record of the actual use for a given pasture and allows for comparison with suggested carrying capacities. It also will allow for the monitoring of season of use as well as a change in carrying capacity for each pasture over a period of years. In addition, data collected on the season end utilization of the key species will provide information relative to the vigor and trend of the plant community.

For each pasture, record the class and number of livestock, turn-in and turn-out date, and total days of grazing for each grazing period. From this data the total animal unit months (AUM'S) of grazing use for each pasture on a yearly basis will be calculated. Animal unit days (AUD'S) of grazing may be substituted if the producer feels that this unit of measure provides more detail or is easier to interpret.

A key management species should be selected for each pasture. The key species should be perennial, palatable to the grazing animal during the season of use, provide at least 15 percent of the available forage, and play a key part in the management objectives for the plant community. Several key species may need to be chosen for pastures that are grazed more than once during the growing season to reflect changing livestock preference. The season end degree of use or utilization for the key species in each pasture should be recorded. Degree of use is the percentage of a plant's weight removed by grazing. It is not a height percentage. Degree of use may be estimated by first finding the midpoint (50 percent use) of an ungrazed sample of the key species. This is easily done in the field by balancing ungrazed plants on a pencil, knife blade, or similar object. Once this midpoint is found it can be used as a reference to compare to the grazed plants. Producers will often find it helpful to estimate utilization by classes rather than to the nearest percent. Utilization classes of 1-20, 21-40, 41-60, 61-80, and 81-100 percent are easier to estimate than actual use and will still provide adequate data.

Degree of use should be obtained from a key area of the pasture which provides a significant amount of the available forage, is readily accessible, and is all of similar soil type or range site. Do not take utilization estimates close to water or in areas not easily accessible to livestock. Think of key areas as representing the "average" utilization in the pasture.

The attached form will provide a location for the producer to record livestock grazing and utilization records. A section for remarks is included. Notes on items such as noxious weed or poisonous plant location and treatment, water shortages or quality concerns, supplementation, and animal health problems should be recorded.

VEGETATIVE RECORDS

Vegetative records will consist of yearly photo plots, frequency data for the key management species, ground cover measurements, range condition assessments, and evaluations of resource concerns. Ideally, vegetative data will be collected from as many locations as necessary to adequately represent the dominant soil, vegetation, and landscape conditions found within the management system. Transects may also be located in or near critical areas to show vegetative changes for these areas of concern.

Actual site selection for the transect is somewhat dependent upon the nature of change anticipated and the subsequent use of the photos and data. Any individual transect must be located entirely within a single range site, condition class, aspect, and slope range.

Consideration should be given to the inclusion of permanent background features when selecting transect and photo point location or starting points. They will add depth and show trend changes to general view photos. When selecting a transect site it may be helpful to scan the area through the camera to determine what will be included in the general view photos.

Disc blades with rebar stakes welded to the concave can be used to designate the starting point of each transect. Bright orange paint will make the disc easier to see. The direction and distance of the disc from a permanent marker such as a corner post, tree, or water tank should be recorded on the back of the Range Monitoring Worksheet to aid in relocating the disc for future data collection.

PHOTO PLOTS

The photo plot is a key part of the monitoring procedure. Photos from successive dates may be compared and changes noted. Photos should be taken at least once a year at a specific time, either in the fall at the end of the grazing season, or in the early summer when warm season grasses are clearly evident, the cool season component is still visible, and the phenology of the dominant plants is optimum for plant identification. If time allows for photos to be taken at both these times more information will be obtained. Plots must be photographed as close to the same date every year as possible. Much of the other data collected during the monitoring procedure is used to supplement and interpret the photo points. Thus, it is imperative that the procedure for completing the photos be followed.

A 35mm camera with a 50mm lens is desirable but not required. Many of the new fully automatic small pocket size cameras will do an adequate job. Color print film with an exposure index of 100 or 200 is recommended because of their ability to record fine detail. Prints are easier to file and examine than slides and their exposure is somewhat less critical.

Once the permanent starting point for the transect has been located, a permanent photo point can be established. Establish a permanent plot a minimum of 20 feet from the center of the disc blade. Delineate the

photo plot by placing a frame on the ground. A convenient frame which is easier to see may be made of two six-foot folding carpenter's rules folded to form a two-foot by two-foot or three-foot by three-foot square. The sampling frames used in collecting frequency and cover data generally do not show up well enough in the photos and should not be used. When establishing the photo plot make sure it is representative of conditions of the site. Permanently mark the plot's location by driving stakes, large nails, rebar, etc., into the plot corners. Make certain that these markers are driven far enough into the ground to avoid damage to vehicles. A few rocks at the corners, orange paint, or any other material which will make it easier to relocate the plot is recommended. Record the distance and direction of the photo plot from the transect starting point on the back of the Range Monitoring Worksheet.

With a felt pen and a yellow pad (white is too bright) make a plot sign to be included in the plot photo. At a minimum the sign should include the pasture number and date. Place the sign adjacent to the plot. Stand so your shadow does not cast across the plot. Photograph the plot at the most vertical angle possible to insure that the frame and the sign are included.

Step back from the plot as far as necessary to get an oblique photograph of the plot and the skyline to the rear. Sky should occupy only about one-third of the upper portion of the scene. Take the oblique photos from each of the four sides of the plot. Try to make any shadows which you may cast as inconspicuous as possible. Often overcast days will provide for better colors and less shadow problems than sunny days. Figure 1 provides a pictorial view of the photo plot procedure.

The five photographs represent a photographic record of the plot. Store the negatives in an envelope and the photos in an album sleeve and place both in the monitoring manual.

FREQUENCY DATA

From the transect starting point a paced transect will be conducted to determine the frequency of the dominant or management sensitive species and ground cover. The producer and other range management personnel will first need to decide which species they wish to monitor. The species which it is felt will be affected with the implementation of the management program should be listed. For example, if the sites are currently dominated by cool season invader species such as smooth brome and Kentucky bluegrass and the management goal is to increase the amount of the warm season grasses such as big and little bluestem, then these four species should be listed. Forbs and shrubs may also be listed, especially desirable legumes or species important to wildlife. Picking the species to be included is an important process as conclusions on trend can only be made if the species are chosen and data collected. It is better to include rather than exclude species when in doubt. The attached form can be utilized for recording the vegetative data.

Once the species have been selected, frequency estimates along the transect can begin. Start at the disc and take a minimum of two paces toward a predetermined direction and locate the 0.96 sq. ft. circular frame at the tip of your foot. Pacing towards a distant object such as a windmill, telephone pole, etc., will help eliminate bias and aid in relocation. If the species chosen for monitoring is present within the plot frame, place a dot in the box next to that species. Continue

pacing in the same direction and record species presence at every other step until 100 plots have been sampled. Keep track of the number of plots sampled in the space provided. As you record each plot be certain that you stay within the same range site. If a new range site is encountered make a 90 degree turn to the right and continue sampling. Make as many turns as needed to assure only one site is sampled. Small inclusions which represent different range sites may be skipped over. Simply walk over these areas and continue the transect on the other side. The direction the transect is run should be recorded on the back of the form making sure to note any identifying characteristics.

When finished with the transect record the total tally for each species. In subsequent years the same species should be sampled so trend can be monitored. New species may be added in the future but it will be a minimum of two years before any trend estimates can be made.

COVER DATA

At each of the 100 plots where plant frequency data is recorded a ground cover measurement will be taken. A piece of tape wrapped around the frequency sampling frame will act as the sample point. The cover measurement will be taken directly beneath the edge of the piece of tape. At this point slowly lower a survey flag, welding rod, or other pointed object until it contacts the ground and record the material encountered as either: (1) live plant material or litter or (2) rock, bare soil, dung etc. When finished with the 100 points record the total of each cover type.

RANGE CONDITION

The range condition score for the range site where the transect is located should be calculated. Range condition will change more slowly than frequency and cover estimates. Therefore, range condition should be calculated the first year the monitoring is initiated and then every two or three years thereafter. The range condition score is obtained by measuring (double sampling method) or estimating species composition by weight and comparing these figures to the appropriate Range Condition Guide from Section II of the South Dakota Technical Guide. A double sampling method is described in the Soil Conservation Service National Range Handbook. This technique is recommended for individuals who are not familiar with estimating forage weights. It also will remove some of the variability which occurs when different individuals complete the monitoring process. Estimates should only be made by individuals comfortable with this procedure. A convenient form which may be used to calculate species composition and range condition is the attached SD-ECS-5.

PASTURE DATA

As you drive to and from the transect starting point as well as when you are running the transect, be observant of other resource concerns and signs of ecosystem health. Simply check the appropriate boxes which represent the conditions present within the pasture. Precipitation data can be obtained from climatic records. Grazing use information is available from the livestock grazing record if cattle were removed from the pasture shortly before the transect was read. If not, make estimates at the time the transect is read and photos taken.

A qualitative estimate of slight, moderate, or severe soil erosion should be made. Signs of active soil erosion include pedestaled plants, sheet and rill erosion, or deposition along water courses. Presence or absence of gullies or blowouts is noted as is their degree of degradation. Livestock trailing will be described as either slight or none, moderate, or severe.

The overall vigor of key desirable management species sampled along the transect will be recorded. Signs of improving vigor include an increase in seed production, plant size, litter accumulation, presence of seedlings, and rhizome, or stolon production. If bunch grasses are present, the presence or absence of dead centers will be noted.

The number of plants that appear to be pedestaled due to soil erosion will be noted as either none, few, or conspicuous. This information, when combined with the previously described soil erosion and plant evaluations, will be used to project an estimate in soil stability and a trend in vegetation of either up, down, or not apparent.

All pertinent remarks which affect the data collected during this procedure should be recorded on the form. This may include information on weather, livestock, range improvements, weeds, insects, etc.

DATA INTERPRETATION

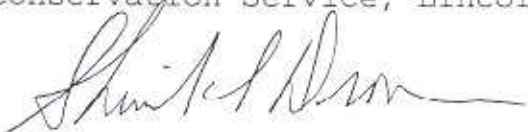
Much of the data collected during monitoring can be displayed graphically. The attached form can be used to graph up to ten years of precipitation, AUM's harvested, plant frequency, ground cover, and utilization data. Data displayed in such a manner will allow for easier interpretation. Always try and collect as much data as possible every year. If collected on a regular basis the monitoring will provide invaluable information for evaluating present management and implementing future changes.

REFERENCES

Monitoring Montana Rangeland, Coop. Ext. Serv., Bull. 369, Bozeman, MT., by John E. Taylor and John Lacey, Montana State University.

Rangeland Monitoring Handbook For Ranchers, Draft Copy by Greg Reeves and James Johnson, South Dakota State University. Unpublished.

Rangeland Monitoring Technique, by Kenneth L. Hladek, Soil Conservation Service, Lincoln, Nebraska.



SHERIDAN DRONEN
State Resource Conservationist

File Under: Range

WEATHER RECORDS

INSTRUCTIONS:

1. Record precip. each day at the same time.
2. Record precip to nearest 1/100 of an inch (.01 etc.)
3. Record trace if precip. is less than .01".
4. Record severe weather, temps. etc. in remarks col.

NAME _____

YEAR _____

COUNTY _____

LEGAL DESC. _____

	APR.	MAY	JUNE	JULY	AUG.	SEPT.	REMARKS – severe weather, storm damage, temperatures etc.
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
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19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
TOTAL							

WEATHER RECORDS

	OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	REMARKS – severe weather, storm damage, temperatures etc.
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
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21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
TOTAL							

OPER, R _____ GRAZING SEA. 19 _____ COUNTY _____

ASSISTED BY _____ DATE _____

[illegible]

*These items must be completed by the cooperator.

Kind/class of animal	AU
<u>CATTLE</u>	
Cow (1200-1300 lb) and calf (spring calving).....	1.20
Cow (1000 lb) and calf (spring calving).....	1.00
Calf (spring calving, 3-4 months postpartum to weaning).....	0.30
Replacement heifers (24-36 months).....	1.00
Cow (1000 lb) non-lactating.....	0.90
Two-year old steers.....	0.90
Yearling cattle (18-24 months).....	0.80
Yearling cattle (12-17 months).....	0.70
Weaner calves (under 12 months).....	0.50
Young bulls (12-24 months).....	1.20
Bulls (24-60 months).....	1.50
<u>HORSES</u>	
Yearlings.....	0.75
Two-year old horses.....	1.00
Mature light horses.....	1.25

Kind/class of animal	AU
<u>SHEEP</u>	
Sheep (mature).....	0.20
Lamb (weaned to yearling).....	0.12
Lamb (yearling).....	0.15
Ram.....	0.25
<u>GOATS</u>	
Goat (mature).....	0.15
Kid (yearling).....	0.10
<u>WILDLIFE</u>	
Deer (white-tailed, mature).....	0.15
Deer (mule, mature).....	0.20
Antelope (mature).....	0.20
Bison (cow, mature).....	0.90
Bison (bull, mature).....	1.50
Bison (herd average).....	1.20
Elk.....	0.60

- (1) PASTURE NUMBER OR NAME: Enter the pasture number or name for which grazing records are to be kept.
- (2) LIVESTOCK CLASS: Enter the livestock class (cow/calf, bull, lamb, etc.) for each grazing period.
- (3) LIVESTOCK NUMBER: Enter livestock numbers by class for each grazing period.
- (4) AU EQUIV: Use the animal unit equivalents from above, or divide the average weight of cattle for the mid-point of the grazing period by 100.
- (5) TOTAL AU: Multiply column 3 by column 4.
- (6) DATE IN: Enter month and day livestock enter the pasture.
- (7) DATE OUT: Enter month and day livestock leave the pasture.
- (8) DAYS GRAZED: Enter the total number of days of livestock grazing for the period.
- (9) PASTURE NUMBER/ACRES: Enter pasture numbers and corresponding acres.
- (10) SUGGESTED CARRYING CAPACITY IN AUM'S: Enter the suggested carrying capacity from form SD-CPA-39 or other source.
- (11) ACTUAL AUM's GRAZED: Multiply column 5 by column 8 and divide by 30.
- (12) TOTAL AUM's GRAZED: Add column 11 Actual AUM's Grazed for all grazing periods by pasture.
- (13) KEY SPECIES: Enter the Key Species name for which utilization was estimated.
- (14) DEGREE OF USE: Estimate the percent use by weight of the key species and enter the appropriate utilization class.

UTILIZATION CLASSES

1 = 0-10%	4 = 60-80%
2 = 11-30%	5 = 81-100%
3 = 30-60%	

OBSERVATIONS AND DATES (Weather, Forage, Livestock, etc.) _____

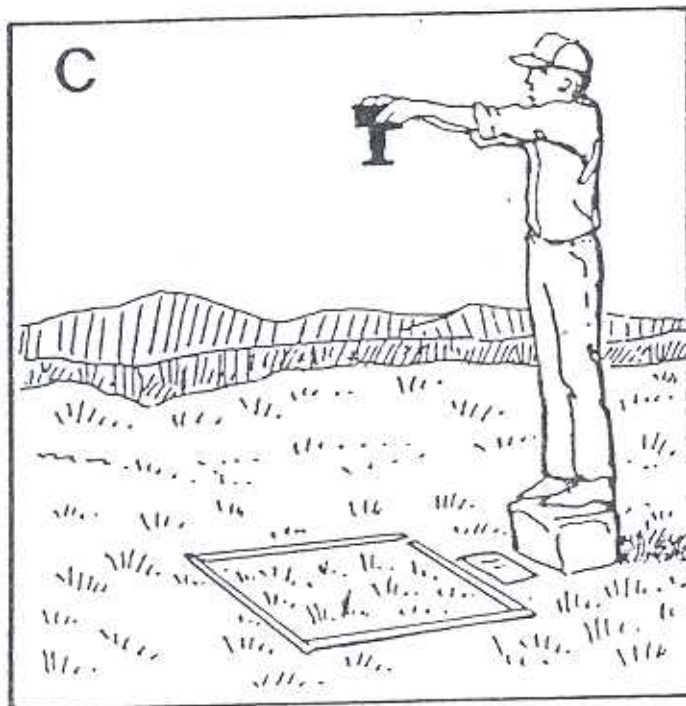
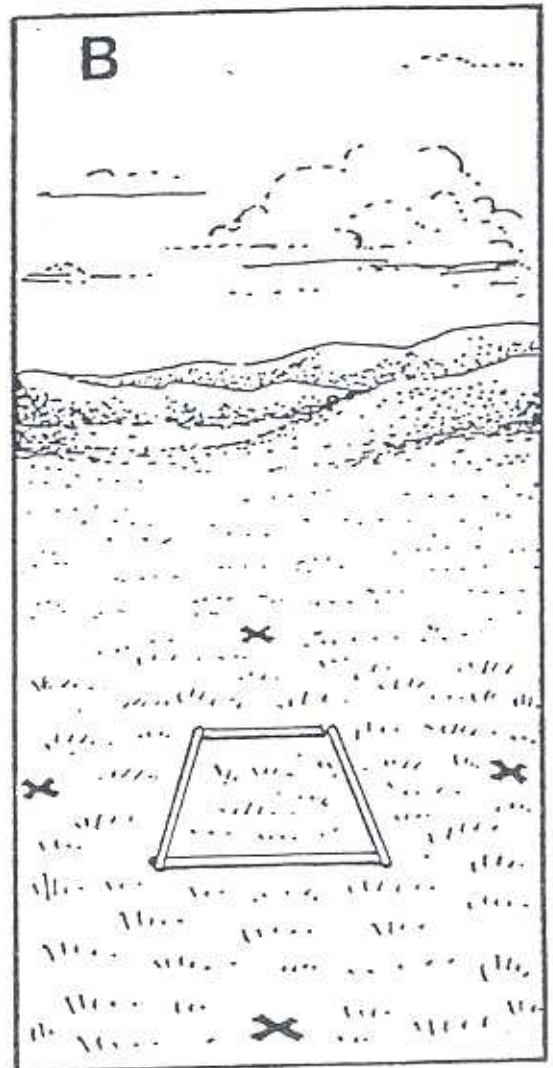
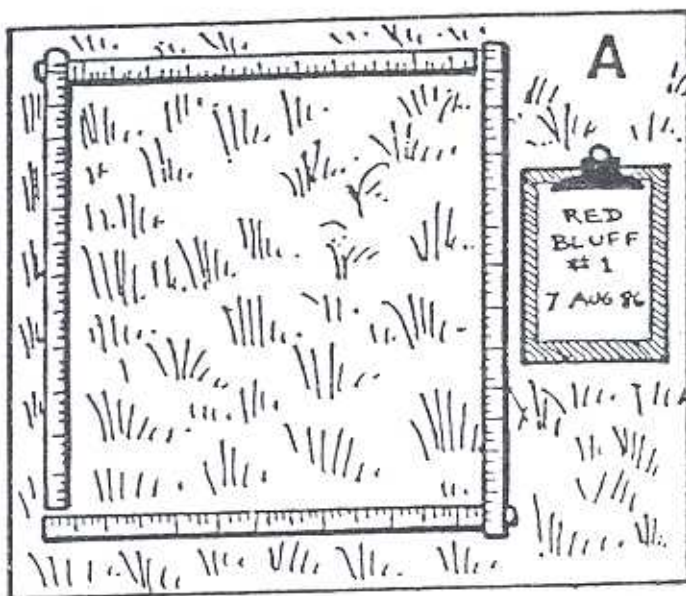


Figure 1.

- A. The 2x2 or 3x3 square foot plot should be photographed as near to vertical as possible.
- B. Photograph the plot with the skyline in the background.
- C. Stand so your shadow does not cast across the plot.

RANGE MONITORING WORKSHEET

COOPERATER _____
ASSISTED BY _____DATE _____
COUNTY _____PASTURE NO. _____
RANGE SITE _____

TRANSECT FREQUENCY DATA:

SPECIES	TALLY	TOTAL

TOTAL
PLOTS
SAMPLED

TALLY	TOTAL

GROUND COVER DATA:

COVER TYPE	TALLY	TOTAL
BARE SOIL ROCK, DUNG ETC.		
LITTER		
LIVING PLANT		

RANGE
CONDITION

PASTURE DATA:

ANNUAL PRECIPITATION	ABOVE AVERAGE	
	AVERAGE	
	BELOW AVERAGE	
LIVESTOCK USE	SEVERE 81-100%	
	CLOSE 61-80%	
	FULL 41-60%	
	MODERATE 21-40%	
	SLIGHT 1-20%	
OBSERVED SOIL MOVEMENT	SLIGHT-NONE	
	MODERATE	
	SEVERE	
GULLIES AND BLOWOUTS	NONE	
	OCCASIONAL	
	FREQUENT	
GULLIES AND BLOWOUTS	SIDES STABLE	
	SIDES UNSTABLE	
	BOTTOMS STABLE	
	BOTTOMS UNSTABLE	
TRAILING	SLIGHT-NONE	
	MODERATE	
	SEVERE	
PLANT VIGOR OF KEY SPECIES	GOOD	
	FAIR	
	POOR	
DEAD CENTERS OF BUNCH GRASSES	NONE	
	FEW	
	CONSPICUOUS	
PLANTS PEDESTALED	NONE	
	FEW	
	CONSPICUOUS	
ESTIMATE OF TREND IN SOIL STABILITY	UP	
	DOWN	
	NOT APPARENT	
ESTIMATE OF TREND IN VEGETATION	UP	
	DOWN	
	NOT APPARENT	

REMARKS:

LOCATION MAP

SECTION _____

TOWNSHIP _____

RANGE _____

DESCRIPTION: _____

GENERAL INSTRUCTIONS:

Refer to the Technical Note on rangeland monitoring for detailed instructions on locating, establishing, and reading permanent transects and photo points. Once the transects have been permanently established they should be read at approximately the same time every year generally in the late summer or early fall. A minimum of 100 points along a pace transect should be sampled. Record all the pertinent data on the header of the form as well as the detailed description of transect location and direction in the space provided above.

TRANSECT FREQUENCY DATA:

First select the key management species for which frequency data will be collected. Enter either the common or scientific name of the selected species. From the transect starting point begin pacing in a pre-determined direction. Place the .96 foot circular frame at your toe and record the presence of the previously selected key species by the dot count method. To reduce bias, determine at which pace you are going to take the sample prior to starting. Make certain that you remain within the same range site. When you are about to leave the range site make a 90 degree turn to the right and continue sampling. Continue turning as necessary. Simply skip over small inclusions when encountered. Keep track of the total of plots sampled by dot counting in the available spaces. Once 100 plots have been sampled record the total number of times each species was observed in the total column.

GROUND COVER DATA:

At each of the 100 locations where frequency data is measured a ground cover measurement will be taken. The measurement will be made directly below a pre-determined location on the .96 square foot frame (the edge of a piece of tape or the cable coupler). Slowly lower a survey flag or similar pointed object below this point and record the cover encountered at ground level. Use the dot tally method and record as either bare soil, rock, dung etc, or cover (living plant, litter). Once 100 plots have been sampled record the total tally for each cover type.

RANGE CONDITION:

Calculate the percent range condition for the range site where the transect was read. This should be done when the transect is first established and periodically thereafter (every two to three years). Procedures for calculating range condition can be found in the National Range Handbook. Range condition guides can be found in section II of the South Dakota Technical Guide. Use SCS form SD-ECS-5 to calculate range condition.

PASTURE DATA:

Check the appropriate box which reflects the conditions within the pasture where the transect is located.

REMARKS:

Record any data which you feel is pertinent to making judgments on the trend within this pasture. This may include information on weather, livestock, range improvements, weeds, insects etc.

Range Site _____ Land Resource Area _____
Location _____
Operating Unit _____ Pasture _____
Determined by _____ Date _____

Species Present	Approximate Potential*	Present Plant Community	
		Estimated Amount	Allowable Amount**
Total (lbs. or %)			
Range Condition			
Range Condition Class			

* Approximate potential is the maximum amount shown for the species on the Guide for Rating Range Condition for the specific site.

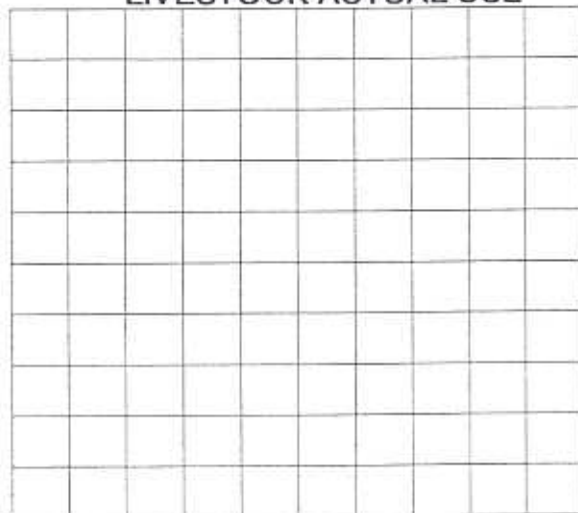
** Can be equal to but not in excess of the approximate potential.

NAME _____

PASTURE NO. _____

A
U
M
S

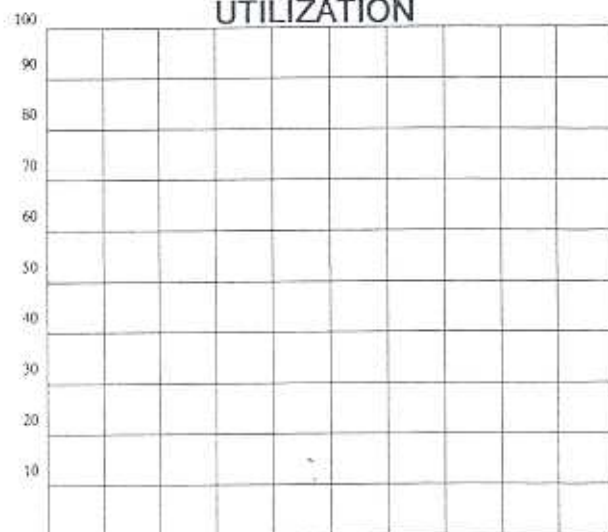
LIVESTOCK ACTUAL USE



YEAR

P
E
R
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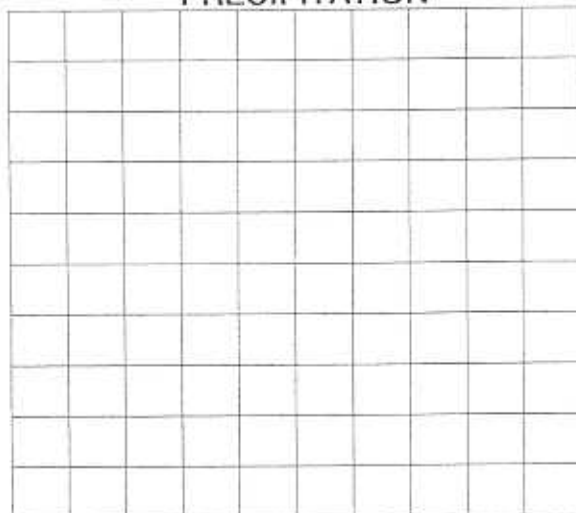
UTILIZATION



YEAR

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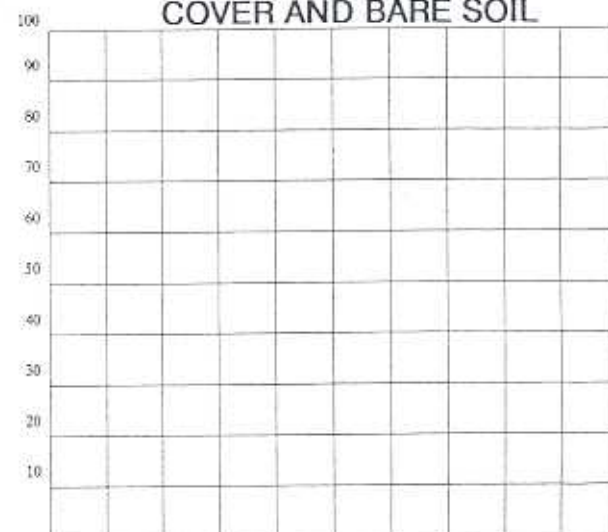
PRECIPITATION



YEAR

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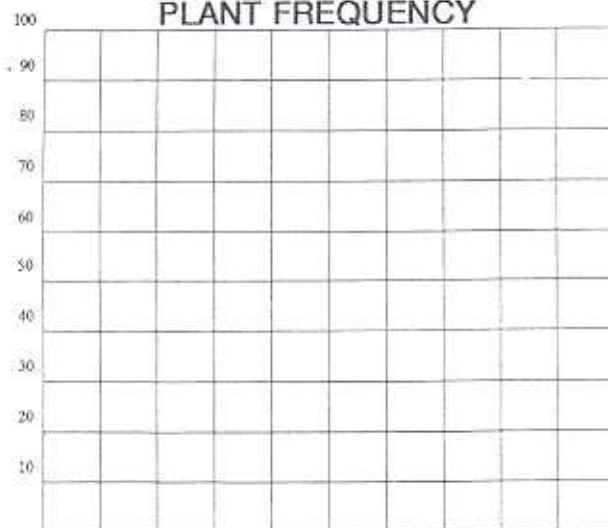
COVER AND BARE SOIL



YEAR

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C
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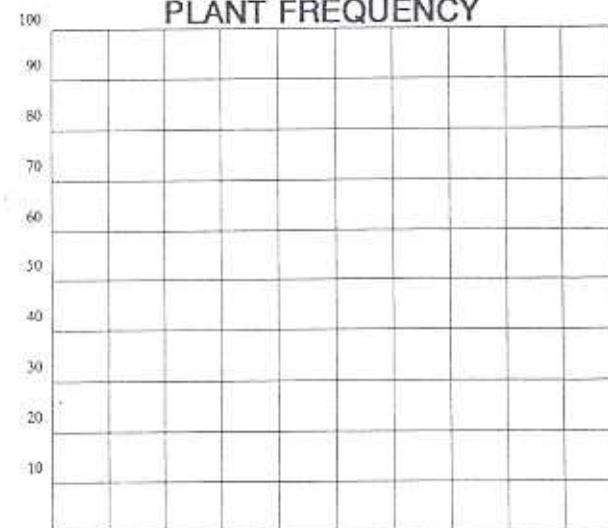
PLANT FREQUENCY



YEAR

O
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C
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PLANT FREQUENCY



YEAR

